Supporting Information for

A Molten Salt Lithium-Oxygen Battery

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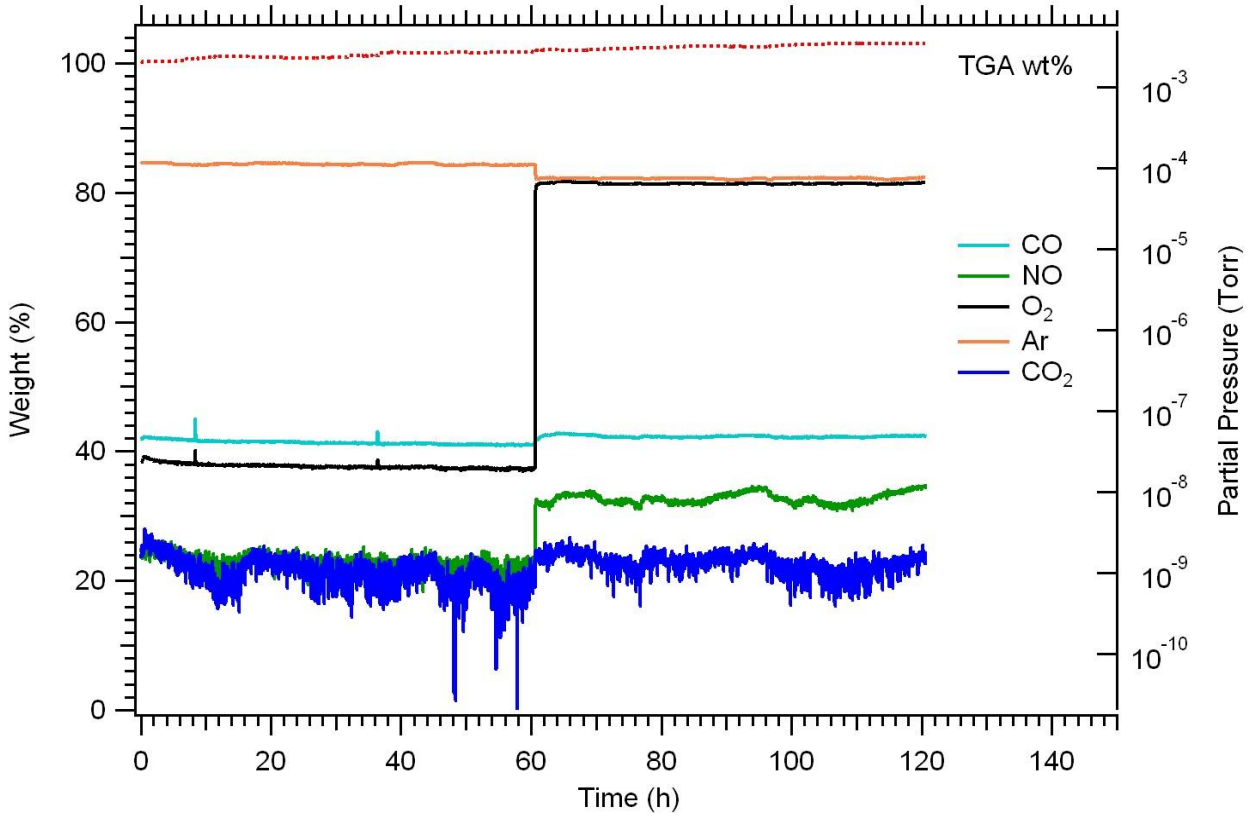

Figure S1. TGA-MS analysis of a Super P carbon:PTFE/Li_2O_2/(Li,K)NO_3 mixture (1/1/3 mass ratio). Sample is heated up (5 °C/min) and kept at 200 °C first under Ar then under O_2 (both for 60 hours). Mass fragments 28 (CO), 30 (NO), 32 (O_2), 40 (Ar) and 44 (CO_2) are monitored (right y-axis). Note that the baseline for mass 28 (CO, light blue), 30 (NO, green) and 44 (CO_2, dark blue) varies depending upon the carrier gas (Ar or O_2).

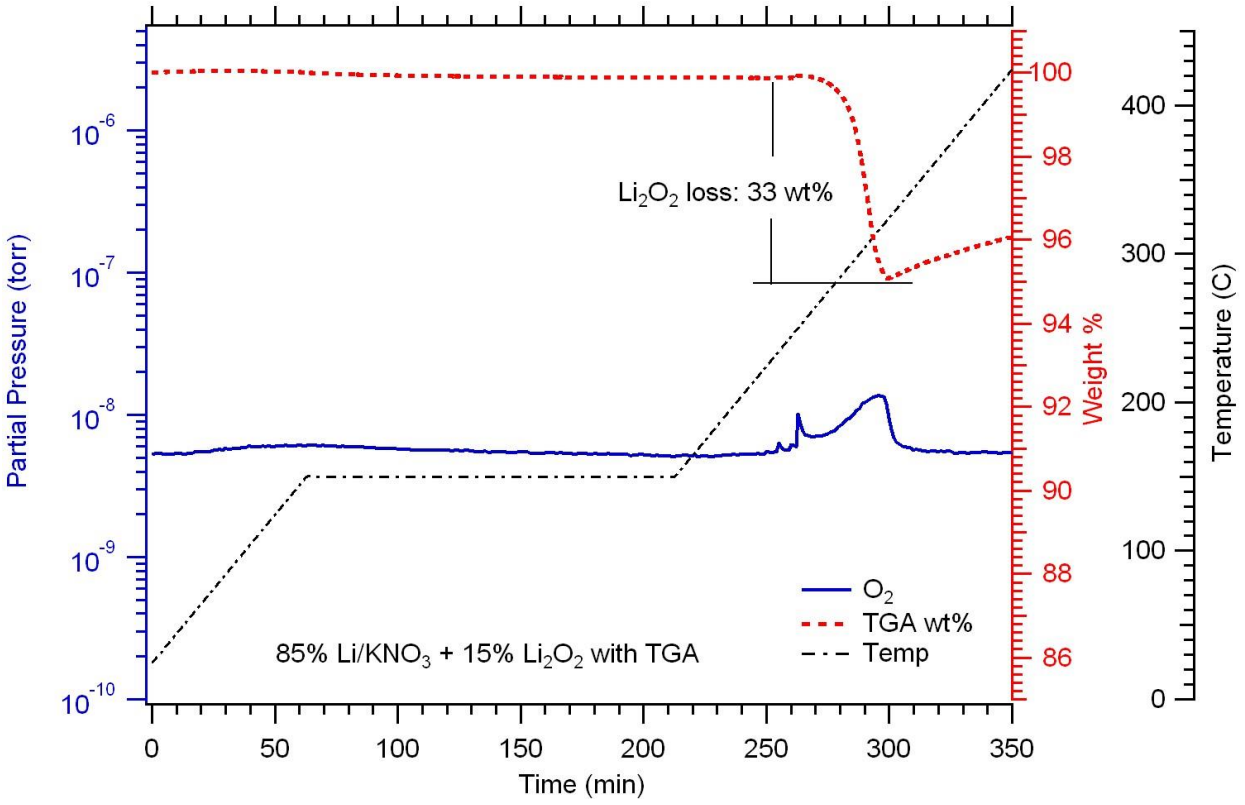

Figure S2. TGA-MS analysis of a (Li,K)NO_3/Li_2O_2 mixture (85/15 wt.%) heated up to 150 °C at 2 °C/min, held at 150 °C for 2,5 hours then heated up to 400 °C at 2 °C/min. $2Li_2O_2 \rightarrow 2Li_2O + O_2$ thermal decomposition typically observed around 250 °C. Expected weight loss (95% pure Li_2O_2): 33.1%.

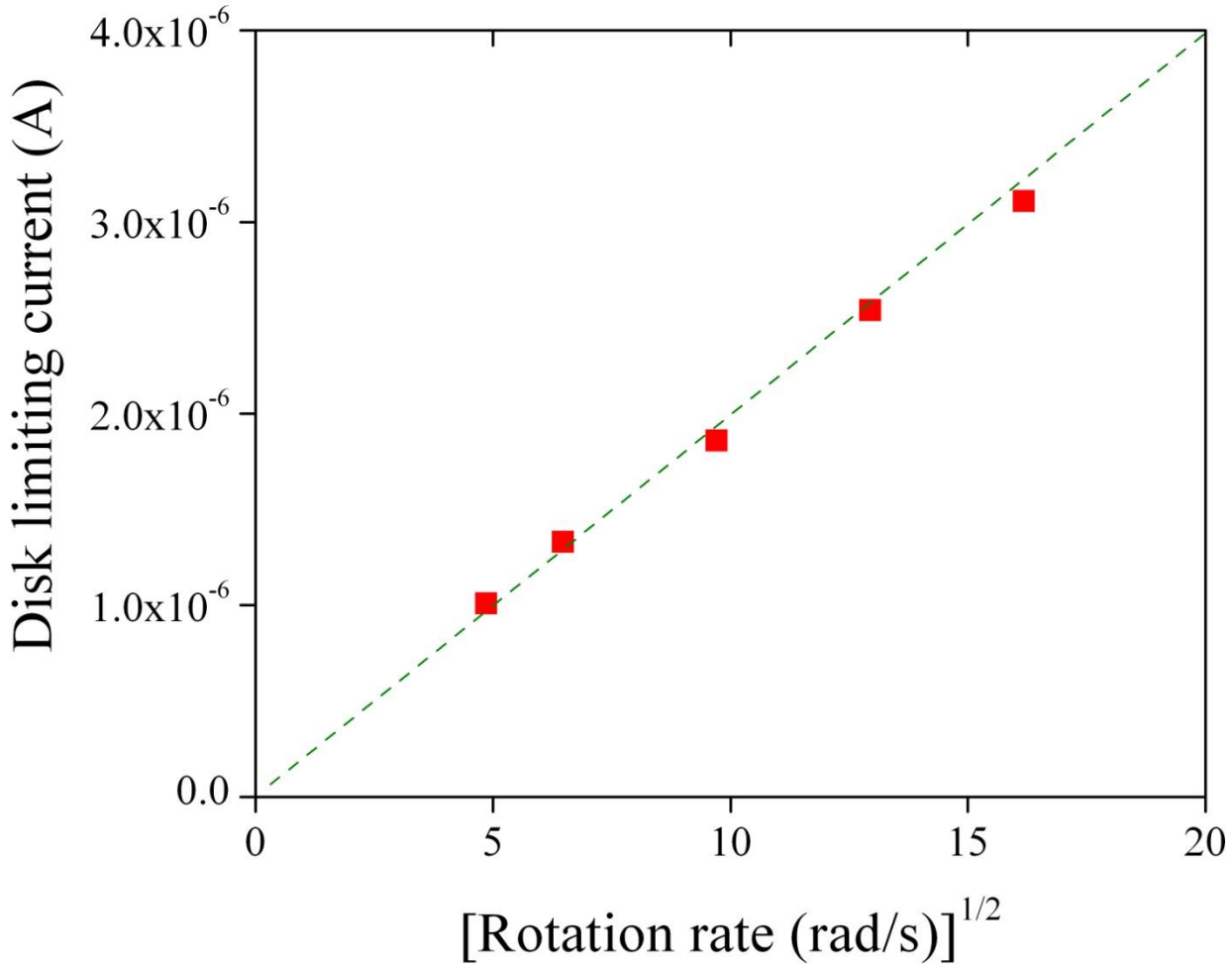

Figure S3. Levich plot derived from linear sweep voltammograms recorded at various rotation rates for Li_2O_2 bulk oxidation in (Li,K)NO_3 molten salt electrolyte. Working electrode: Pt RDE (A= 0.196 cm^2), T= 150 °C, sweep rate= 1 mV/s. The limiting current increases linearly with the square root of the rotation rate, and the line intercepts the vertical axis at zero, as predicted by the Levich equation ($i_L = 0.620nFAD^{2/3}\nu^{-1/6}C\omega^{1/2}$). Kinematic viscosity ν of $LiNO_3$-KNO_3 eutectic at 150 °C: 5.82x10^{-2} cm^2/s.

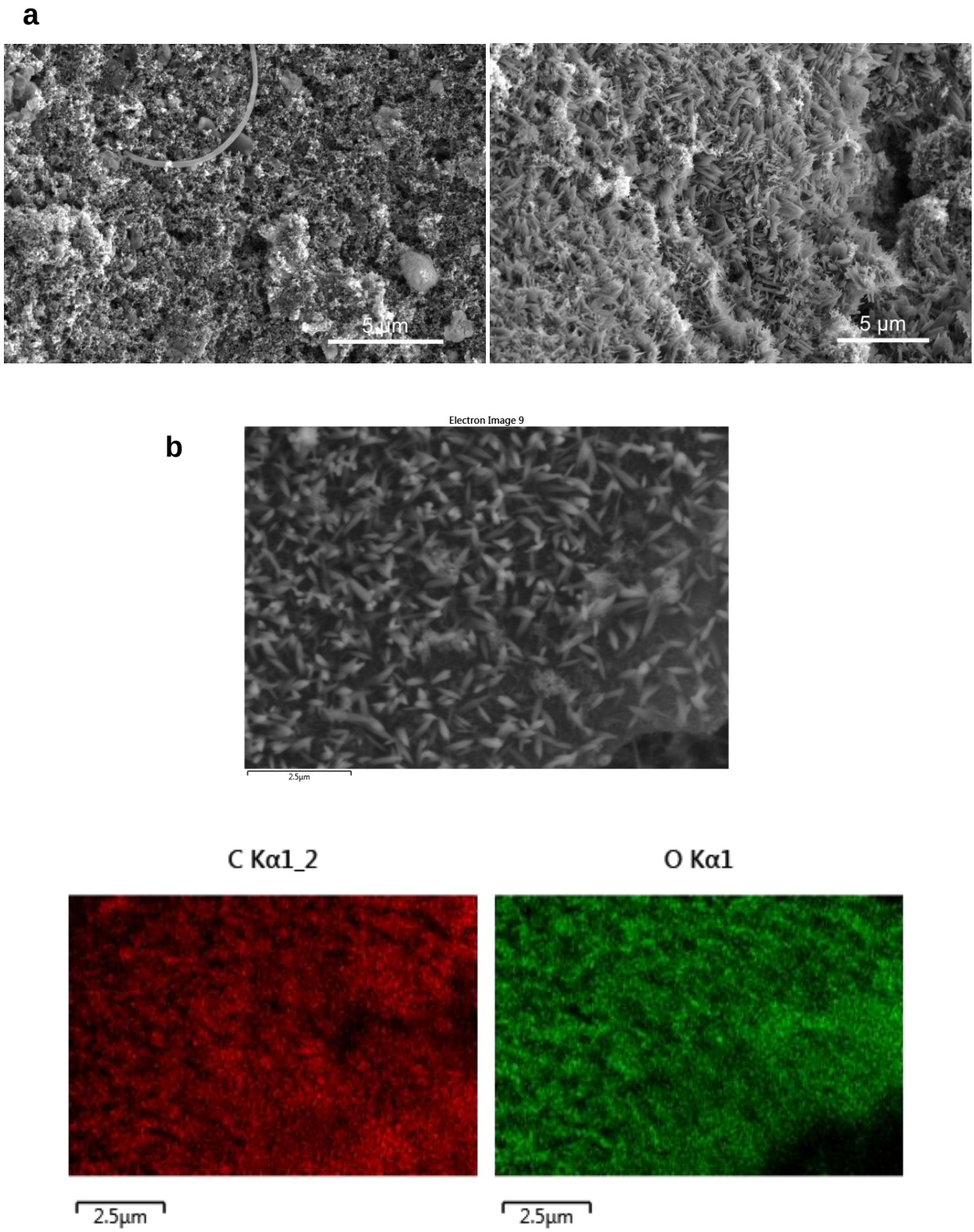

Figure S4. a) SEM analysis of a Super P carbon:PTFE air cathode following the 1st cycle (battery was fully charged to 3.0 V cutoff), confirming complete removal of Li_2O_2 (500 nm to several microns in diameter hexagonal prisms). Left image: amorphous carbon nanoparticles; right image: Li_2CO_3 particles covering the electrode surface. b) Elemental analysis performed on the area covered by Li_2CO_3.